



## The deep-sea Anguilliformes and Saccopharyngiformes (Teleostei: Elopomorpha) collected on the Brazilian continental slope, between 11° and 23° S

MARCELO R. S. MELO<sup>1,4</sup>, GUSTAVO W. A. NUNAN<sup>2</sup>, ADRIANA C. BRAGA<sup>3</sup> & PAULO A. S. COSTA<sup>3</sup>

<sup>1</sup> 331 Funchess Hall, Auburn University, Auburn, AL 36849 USA. E-mail: mrs Melo@hotmail.com

<sup>2</sup> Dept. de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista, Rio de Janeiro, RJ 20940-040 Brazil

<sup>3</sup> Laboratório de Dinâmica de Populações, Universidade Federal do Estado do Rio de Janeiro – UNIRIO, Av. Pasteur, 458, ECB sala 410, Urca, Rio de Janeiro, RJ 22290-240 Brazil, Email: acbragaz@hotmail.com; pauloascosta@uol.com.br.

<sup>4</sup> Corresponding author

### Abstract

A review of the deep-sea anguilliform and saccopharyngiform eels collected by the French R/Vs *Marion Dufresne* (1987), *Thalassa* (1999, 2000), and the Brazilian *Astro Garoupa* (2003) revealed a great diversity of these groups on the Brazilian continental slope (11–23° S, 19–40° W), in the depth range of 233 to 3450 m. Of the 33 species collected, 13 (39.4%) are being reported for the first time in the western South Atlantic. New taxa are represented by one species recently described and few other are probably undescribed. The most species-rich family in the area was Synphobranchidae (11 species), followed by Congridae (9), Nettastomatidae (5), Nemichthyidae (3), Serrivomeridae (2), Colocongridae (1), Cyematidae (1), and Eurypharyngidae (1). Regarding the vertical species distribution, a gradual transition of species was observed, without any clear break along the slope.

**Key words:** Western South Atlantic; demersal; pelagic; eels; gulper eels

### Resumo

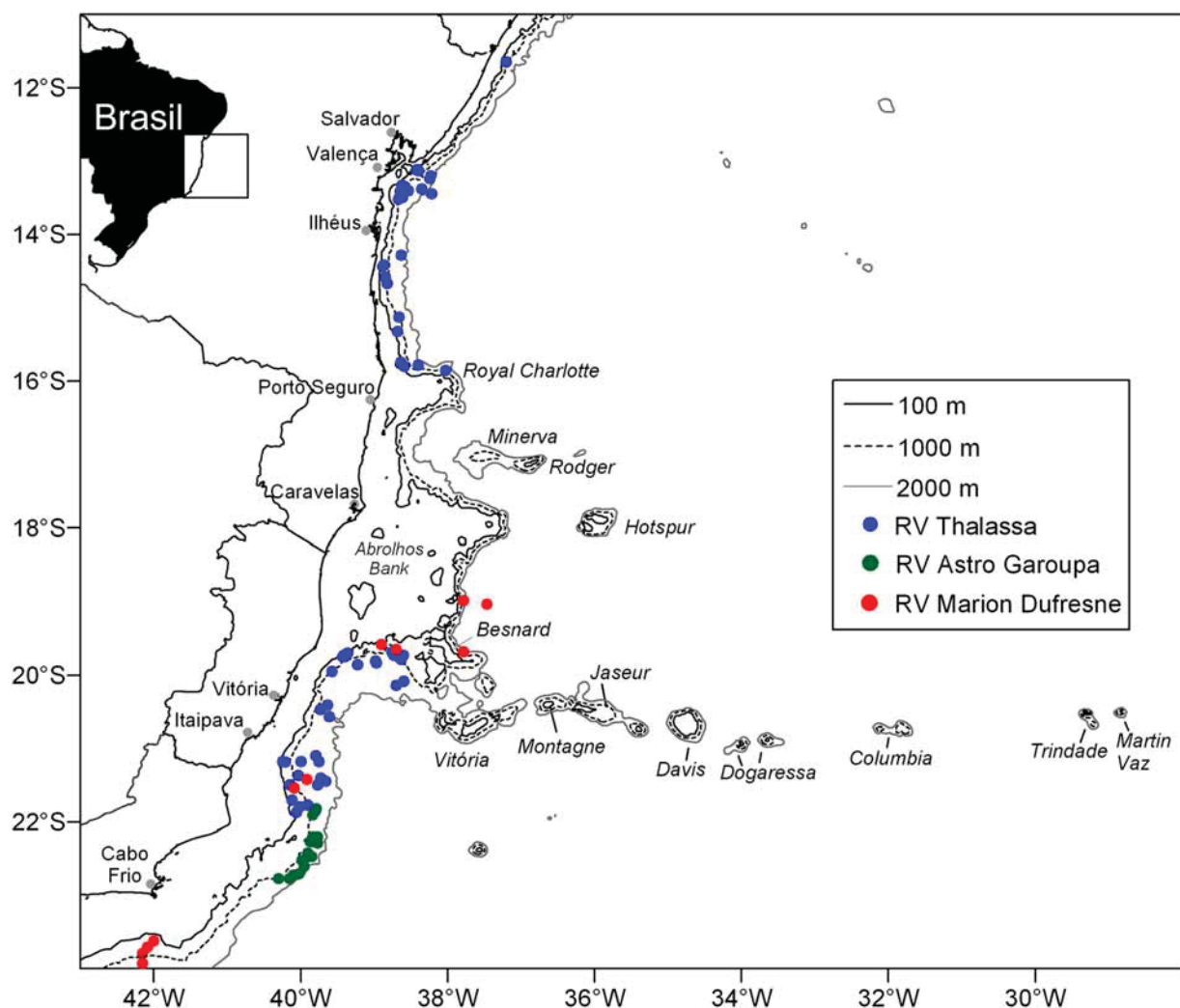
A revisão dos peixes anguiliiformes e sacofaringiformes de oceano profundo coletados pelos navios oceanográficos Franceses *Marion Dufresne* (1987) e *Thalassa* (1999, 2000) e brasileiro *Astro Garoupa* (2003) revelou uma grande diversidade de espécies no talude continental brasileiro (11–23° S, 19–40° W), em profundidades entre 233 a 3450 metros. Das 33 espécies coletadas, 13 (39,4%) são reportadas pela primeira vez no Atlântico Sul ocidental. Novos táxons são representados por uma espécie recentemente descrita e algumas outras provavelmente novas. A família mais diversificada na área foi Synphobranchidae (11 espécies), seguida de Congridae (9), Nettastomatidae (5), Nemichthyidae (3), Serrivomeridae (2), Colocongridae (1), Cyematidae (1) e Eurypharyngidae (1). Com relação à distribuição vertical das espécies, foi observada uma transição gradual de espécies, sem a delimitação bem definida de estratos ao longo do talude.

### Introduction

Knowledge regarding diversity of the deep-water fish fauna in both the Atlantic and the Pacific Oceans off South America remains poor due to relatively few scientific expeditions and, consequently, little material available in scientific collections (Melendéz & Kong 2000; Figueiredo *et al.* 2002). In the early days of modern deep-water investigations (1873 to 1960), only the British H.M.S. *Challenger*, and the German R/V *Meteor* collected biological samples in the western South Atlantic (WSA) – for more details see Wüst (1964).

In contrast a considerable number of surveys have been done over the past 50 years off the coasts of Brazil, Argentina, and the Falkland islands (Castle 1970; Nakamura *et al.* 1986; Séret & Andreata 1992; Haimovici *et al.* 1994; Parin *et al.* 1995; Brickle & Laptikovsky 2002; Figueiredo *et al.* 2002; Costa *et al.* 2007), resulting in a remarkable increase in our knowledge regarding the local deep-water ichthyofauna.

The expeditions to the western South Atlantic resulted in the description of the deep-sea anguilliforms *Avocettina acuticeps* (Regan), *Nemichthys scolopaceus* Richardson and *Synaphobranchus calvus* Melo. An additional 34 species of both anguilliforms and saccopharyngiforms were also recorded from the deep waters of the western South Atlantic (Nakamura *et al.* 1986; Menezes *et al.* 2003). Recently, representative collections of deep-sea fishes from the Brazilian continental slope were obtained by the French R/V *Thalassa* between 1999 and 2000 (Braga *et al.* 2007; Costa *et al.* 2007), and the Brazilian R/V *Astro Garoupa* in 2003. Herein, a check-list of the deep-sea anguilliforms and saccopharyngiforms eels caught during those expeditions is presented, with comments on the distribution of each species. The anguilliforms obtained by the R/V *Marion Dufresne* in 1987 (Séret & Andreata 1992) were also reviewed, and new identifications are provided if necessary.



**FIGURE 1.** Area of study on the Brazilian continental slope, showing the stations trawled by the R/Vs *Thalassa*, *Astro Garoupa* (our data), and *Marion Dufresne* (Séret & Andreata, 1992).

## Material and methods

About 570 specimens and 180 lots were collected during five oceanographic cruises aboard the French R/Vs *Thalassa* and *Marion Dufresne*, and the Brazilian R/V *Astro Garoupa*. The collections were obtained using different types of pelagic and bottom trawls, towed on the Brazilian continental slope from 11°–23° S, and 29°–40° W, in depths of 233 to 3450 m (majority to 2700 m, Table 1,2). Two cruises were made by the R/V *Thalassa*, one in 1999 using a pelagic trawl (76 m x 70 m), and the other in 2000, with a large demersal bottom-trawl (26.8 m x 47.2 m), equipped with 40 rubber-bobbins (rock-hoppers) attached to the ground rope. The R/V *Astro Garoupa* made two cruises in 2003 using an otter-trawl semi-balloon net (OTSB), with the same dimensions as the OTSB Number 14 shrimp-trawl net (5.5 x 1.0 m). Further details on the method of capture are given by Mincarone *et al.* (2008). Demersal stations for the R/Vs *Thalassa* and *Astro Garoupa* are listed in tables 1 and 2. See Séret and Andreata (1992) for complete information regarding methodology and a list of stations trawled by the R/V *Marion Dufresne*. Total area of study including expeditions from the three vessels is shown in figure 1.

For each species listed below the following information is given: lot catalog number and total number of specimens in lot, range in total length of specimens in mm (inside brackets), abbreviation for the R/V (T for *Thalassa*, AG for *Astro Garoupa*, and MD for *Marion Dufresne*), and the collecting station; cs stands for cleared and stained. The overall geographical distributions given for species are based on literature records, and information on type locality follows Eschmeyer (1998). A diagnosis and pertinent taxonomic comments are given only for those species considered as potentially new taxa or those poorly known. Abbreviations of the lender institutions follow Leviton *et al.* (1985) with the addition of USU referring to Universidade Santa Úrsula fish collection (Rio de Janeiro, Brazil). Terminology and methods for meristic and morphometric data follows Böhlke (1989).

## Results

### Anguilliformes

#### Family Colocongridae

##### *Coloconger meadi* Kanazawa 1957

(Fig. 2 A)

**Material examined.** Three specimens, 341.0–382.0 mm TL: MNRJ 26833 (3, 341.0–382.0 mm), T, E-503.

**Distribution.** *Coloconger meadi* was previously known from its type locality in the Gulf of Mexico, and from the Caribbean, French Guiana, Suriname and WSA (Smith 1989a; Uyeno *et al.* 1983; Séret & Andreata 1992).

#### Family Congridae

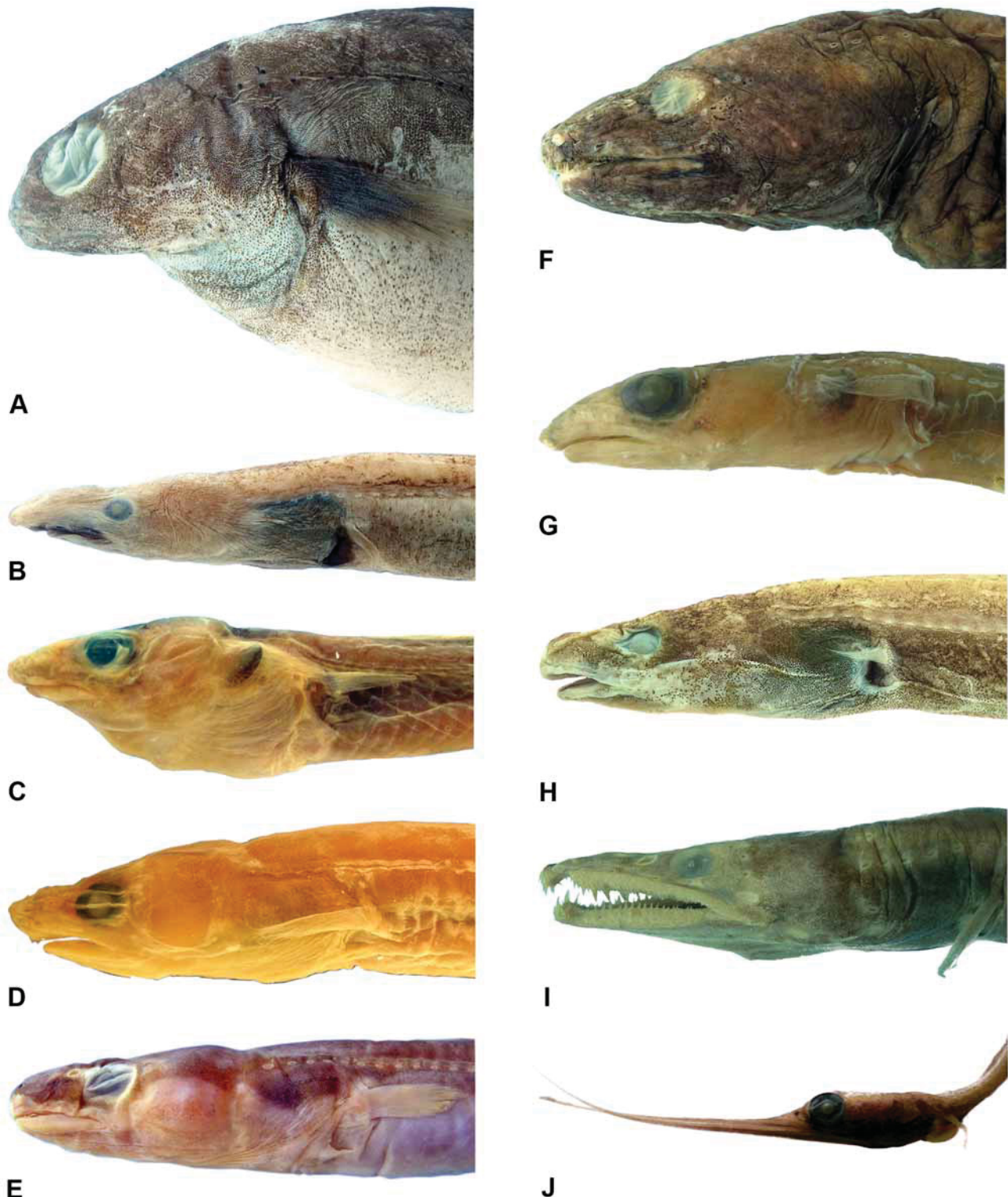
##### *Acromycter atlanticus* Smith 1989

**Material examined.** Two specimens, 180.0–235.0 mm TL: USU 01405 (1, 180.0 mm, x-rayed), MD, 64 CB 105; MNHN 1989-349 (1, 235.0 mm, x-rayed), MD, 64 CB 105.

**Distribution.** *Acromycter atlanticus* is being reported for the first time in the WSA. It was described from the Caribbean Sea, and is also known from off the coast of Florida, USA (Smith 2002).

**Remarks.** Diagnosis of *Acromycter atlanticus* from *A. perturbator* was made based on vertebral counts (167 to 171 in *A. atlanticus* vs. 159 to 164 in *A. perturbator*). Also, *A. atlanticus* is known to inhabit shallower

regions (from 500 to 650 m) than *A. perturbator* (about 1,300 m) (Smith 1989b). Both specimens examined were reported by Séret and Andreata (1992) as *A. perturbator*; other specimens reported by them as *A. perturbator* were correctly identified.



**FIGURE 2.** (A) *Coloconger meadi* (MNRJ 26833, 382.0 mm); (B) *Acromycter perturbator* (MNRJ 27114, 280.0 mm); (C) *Ariosoma* sp. (USU 00998, 254.0 mm); (D) *Bathycongrus dubius* (MNHN 1989-352, 278.0 mm); (E) *Bathycongrus vicinalis* (MNRJ 26831, 323.0 mm); (F) *Bathyuroconger vicinus* (MNRJ 26812, 752.0 mm); (G) *Gnathophipis* sp. (MNHN 1989-351, 277.0 mm); (H) *Pseudophipichthys splendens* (MNRJ 26828, 277.0 mm); (I) *Xenomystax congroides* (MNRJ 26815, 768.0 mm); (J) *Avocettina acuticeps* (MNRJ 27111, 536.0 mm).



**TABLE 1.** List of stations, which collected Anguilliformes and Saccopharyngiformes, made by the French R/V *Thalassa* on the Brazilian continental slope.

Station	Date	Coordinates		Depth range (m)
		Initial	Final	
D-464	22/6/1999	21°48.380'S, 40°01.879'W	21°47.876'S, 40°04.113'W	617–632
D-502	29/6/1999	19°37.692'S, 38°41.111'W	19°37.730'S, 38°39.701'W	705–736
D-503	29/6/1999	19°39.922'S, 38°38.674'W	19°39.550'S, 38°36.127'W	809–847
D-504	29/6/1999	19°42.761'S, 38°36.556'W	19°44.141'S, 38°40.104'W	909–927
D-506	29/6/1999	19°42.711'S, 38°36.487'W	19°42.564'S, 38°32.619'W	922–934
D-538	7/7/1999	no data	13°40.851'S, 38°33.729'W	638–658
E-496	7/6/2000	13°17.580'S, 38°17.599'W	13°12.030'S, 38°14.873'W	1635–1864
E-497	7/6/2000	13°13.841'S, 38°19.525'W	13°14.281'S, 38°15.584'W	1171–1593
E-498	8/6/2000	13°08.243'S, 38°24.766'W	13°08.058'S, 38°24.582'W	614–629
E-499	8/6/2000	13°23.826'S, 38°37.541'W	13°20.872'S, 38°35.922'W	736–803
E-501	9/6/2000	14°13.986'S, 38°40.277'W	14°16.764'S, 38°38.978'W	1591–1709
E-502	9/6/2000	14°28.385'S, 38°52.395'W	14°24.813'S, 38°53.006'W	461–567
E-503	10/6/2000	14°37.834'S, 38°52.029'W	14°34.565'S, 38°51.672'W	714–822
E-505	10/6/2000	14°36.606'S, 38°49.345'W	14°39.662'S, 38°50.154'W	1051–1197
E-506	10/6/2000	14°36.579'S, 38°49.544'W	14°39.605'S, 38°50.134'W	1055–1173
E-507	11/6/2000	15°08.595'S, 38°40.638'W	15°07.158'S, 38°40.542'W	1012–1049
E-510	12/6/2000	15°48.503'S, 38°35.265'W	15°47.383'S, 38°36.154'W	580–615
E-511	12/6/2000	15°42.675'S, 38°37.298'W	15°44.231'S, 38°39.196'W	233–294
E-517	19/6/2000	13°22.173'S, 38°36.566'W	13°24.968'S, 38°38.277'W	727–801
E-518	19/6/2000	13°21.199'S, 38°38.896'W	13°24.353'S, 38°39.782'W	457–607
E-519	20/6/2000	13°19.944'S, 38°19.654'W	13°22.615'S, 38°21.960'W	1726–1929
E-520	20/6/2000	13°21.837'S, 38°16.683'W	13°26.455'S, 38°13.836'W	1981–2271
E-522	21/6/2000	13°30.495'S, 38°38.977'W	13°29.472'S, 38°37.943'W	1044–1275
E-523	27/6/2000	19°42.569'S, 38°32.030'W	19°42.685'S, 38°36.961'W	875–942
E-524	27/6/2000	19°43.663'S, 38°39.838'W	19°42.684'S, 38°44.568'W	895–1004
E-525	28/6/2000	20°08.145'S, 38°38.081'W	20°07.308'S, 38°42.906'W	1614–1680
E-526	28/6/2000	20°06.565'S, 38°40.502'W	20°03.984'S, 38°36.676'W	1636–1649
E-527	29/6/2000	19°50.736'S, 39°10.817'W	19°50.563'S, 39°14.496'W	1342–1444
E-528	29/6/2000	19°45.258'S, 39°03.003'W	19°47.581'S, 38°59.827'W	1183–1318
E-529	29/6/2000	19°48.484'S, 39°02.349'W	19°48.911'S, 38°59.108'W	1426–1441
E-534	30/6/2000	19°42.162'S, 39°21.608'W	19°43.828'S, 39°24.583'W	605–619
E-535	1/7/2000	19°58.936'S, 39°38.657'W	19°56.087'S, 39°35.408'W	984–1016
E-536	2/7/2000	20°24.008'S, 39°46.217'W	20°27.001'S, 39°44.843'W	1209–1362
E-537	2/7/2000	20°26.850'S, 39°41.636'W	20°23.542'S, 39°38.943'W	1522–1567
E-538	2/7/2000	20°27.667'S, 39°38.101'W	20°32.771'S, 39°37.650'W	1645–1762
E-540	4/7/2000	21°12.293'S, 40°00.884'W	21°09.576'S, 40°00.461'W	1334–1391
E-541	4/7/2000	21°13.644'S, 40°14.031'W	21°10.040'S, 40°13.601'W	545–579
E-543	5/7/2000	21°23.944'S, 40°11.292'W	21°28.481'S, 40°09.750'W	625–766
E-544	5/7/2000	21°24.306'S, 40°02.916'W	21°20.953'S, 40°02.847'W	1158–1192

continued next page.

**TABLE 1.** (continued)

Station	Date	Coordinates		Depth range (m)
		Initial	Final	
E-547	6/7/2000	21°46.569'S, 39°53.364'W	21°44.949'S, 39°55.117'W	1081–1141
E-548	7/7/2000	21°28.611'S, 39°40.303'W	21°25.523'S, 39°40.443'W	1790–1806
E-549	7/7/2000	21°25.738'S, 39°43.946'W	21°22.965'S, 39°44.646'W	1712–1721
E-550	7/7/2000	21°26.324'S, 39°49.113'W	21°28.583'S, 39°47.176'W	1594–1614
E-551	8/7/2000	21°07.780'S, 39°49.106'W	21°04.783'S, 39°48.698'W	1633–1665
E-552	8/7/2000	21°07.493'S, 39°46.423'W	21°09.541'S, 39°46.079'W	1686–1699

**TABLE 2.** List of stations, which collected Anguilliformes and Saccopharyngiformes, made by the Brazilian R/V *Astro Garoupa* on the Brazilian continental slope.

Station	Date	Coordinates		Depth range (m)
		Initial	Final	
ASTRO2003020701	7/2/2003	22°24.449'S, 39°55.280'W	22°21.936'S, 39°53.602'W	1128–1135
ASTRO2003020703	7/2/2003	22°10.118'S, 39°48.977'W	22°06.885'S, 39°48.887'W	1318–1319
ASTRO2003020801	8/2/2003	22°30.092'S, 40°00.263'W	22°28.709'S, 39°58.633'W	1122–1147
ASTRO2003020802	8/2/2003	22°27.080'S, 39°54.706'W	22°24.471'S, 39°52.781'W	1299–1320
ASTRO2003020803	8/2/2003	22°27.422'S, 39°52.289'W	22°24.803'S, 39°50.622'W	1640–1649
ASTRO2003021001	10/2/2003	22°42.263'S, 40°07.631'W	22°39.896'S, 40°05.410'W	1321–1324
ASTRO2003021002	10/2/2003	22°45.086'S, 40°10.352'W	22°42.562'S, 40°07.835'W	1322–1326
ASTRO2003021101	11/2/2003	22°42.263'S, 40°07.631'W	22°39.896'S, 40°05.410'W	1320–1323
ASTRO2003021301	13/2/2003	22°15.790'S, 39°53.145'W	22°12.903'S, 39°52.148'W	1071–1205
ASTRO2003021403	14/2/2003	21°53.608'S, 39°51.280'W	21°50.845'S, 39°52.087'W	1060–1074
ASTRO2003082002	20/8/2003	21°53.524'S, 39°50.700'W	21°49.319'S, 39°52.499'W	1077–1082
ASTRO2003082403	24/8/2003	22°15.548'S, 39°51.256'W	22°12.409'S, 39°49.450'W	1330–1332
ASTRO2003082601	26/8/2003	22°26.940'S, 39°52.022'W	22°24.049'S, 39°50.147'W	1627–1630
ASTRO2003082703	27/8/2003	22°39.684'S, 39°58.940'W	22°41.947'S, 40°02.917'W	1602–1605
ASTRO2003082704	27/8/2003	22°41.863'S, 40°05.319'W	22°44.773'S, 40°10.012'W	1305–1318

***Acromycter perturbator* (Parr 1932)**

(Fig. 2 B)

**Material examined.** 60 specimens, 115.0–290.0 mm TL: MNRJ 27096 (2, 147.0–271.0 mm), AG, ASTRO2003021301; MNRJ 27100 (1, 255.0 mm), T, D-502; MNRJ 27101 (3, 239.0–241.0 mm), T, D-504; MNRJ 27102 (1, 267.0 mm), AG, ASTRO2003021403; MNRJ 27104 (1, 272.0 mm), AG, ASTRO2003021002; MNRJ 27105 (2, 267.0–290.0 mm), AG, ASTRO2003020701; MNRJ 27108 (1, 221.0 mm), AG, ASTRO2003020802; MNRJ 27109 (1, 187.0 mm), AG, ASTRO2003082403; MNRJ 27110 (1, 269.0 mm), AG, ASTRO2003020803; MNRJ 27114 (6, 224.0–282.0 mm, 1 cs), T, D-503; MNRJ 27115 (16, 186.0–282.0 mm), AG, ASTRO2003020703; MNRJ 27116 (9, 192.0–265.0 mm, 1 cs), AG, ASTRO2003082704; USU 01402 (6, 234.0–107.0 mm), MD 55 CB 95; USU 01406 (4, 115.0–224.0 mm), MD, 43 CB 77; MNHN 1989-345 (1 of 3, 238.0 mm, x-rayed), MD, 43 CB 77; MNHN 1989-346 (1, 290.0 mm, x-rayed), MD, 44 CB 78; MNHN 1989-347 (2 of 6, 172.0–217.0 mm, x-rayed), MD, 55 CB 95; MNHN 1989-348 (1, 253.0 mm, x-rayed), MD, 58 CB 98; MNHN 1989-350 (1, 288.0 mm, x-rayed), MD, 65 CB 106.

**Distribution.** *Acromycter perturbator* was described from the Bahamas, and is also known from the Caribbean Sea, Gulf of Mexico and the WSA (Smith 1989b; Séret & Andreata 1992).

***Ariosoma* sp.**  
(Fig. 2 C)

**Material examined.** USU 00998, 1 (254.0 mm), MD, 62 CB 103.

**Distribution.** *Ariosoma* sp. is known from a single specimen identified earlier by Séret and Andreata (1992) as *Gnathophis* sp. aff. *mystax* (Delaroche 1809).

**Remarks.** *Ariosoma* sp. is being tentatively identified in the genus *Ariosoma*, despite its lower number of lateral line pores to the level of the anus (e.g. 34 in our specimen vs. 46–52 in *A. balearicum*); further material is needed for a more precise identification. Leptocephali of *A. balearicum* were recorded off Brazil by Castro and Bonecker (2004), and may represent the species reported herein, since adults of that species were never reported from the area.

***Bathycongrus dubius* (Breder 1927)**  
(Fig. 2 D)

**Material examined.** One specimen, 278.0 mm TL: MNHN 1989–352 (1, 278.0 mm), MD, 62 CB 104.

**Distribution.** *Bathycongrus dubius* was described from the Caribbean Sea off Colombia (12°16'N, 72°40'W), and is known from the western Atlantic from off Georgia, USA to Southern Brazil (Castro & Bonecker 2004; Smith 1989b; Menezes *et al.* 2003; Séret & Andreata 1992).

***Bathycongrus vicinalis* (Garman 1899)**  
(Fig. 2 E)

**Material examined.** Three specimens, 286.0–323.0 mm TL: MNRJ 26830 (1, 299.0 mm), T, E-502; MNRJ 26831 (1, 323.0 mm), T, E-534; USU 01251 (1, 286.0 mm), MD, 53 CB 92.

**Distribution.** *Bathycongrus vicinalis* is being reported by the first time in the WSA. It was described from Cuba, and is also known from Florida, USA to off the Amazon River mouth, in Northern Brazil (Smith 1989b). USU 01251 was reported by Séret and Andreata (1992) as *A. perturbator*.

***Bathyuroconger vicinus* (Vaillant 1888)**  
(Fig. 2 F)

**Material examined.** Eight specimens, 720.0–886.0 mm TL: MNRJ 26811 (2, 797.0–840.0 mm), T, E-507; MNRJ 26812 (1, 752.0 mm), T, E-506; MNRJ 26813 (4, 720.0–752.0 mm), T, E-522; MNRJ 26814 (1, 886.0 mm), T, E-523.

**Distribution.** *Bathyuroconger vicinus* is being reported for the first time in the WSA. It was described from several sites off the west coast of Africa and the Cape Verde Islands, and is also known to have a wide distribution in the tropical eastern Atlantic from Cape Verde to Angola, throughout the tropical western Atlantic from the Gulf of Mexico through the Caribbean to the northern coast of South America and the Indo-Pacific, from South Africa to Hawaii (Uyeno *et al.* 1983; Castle 1986a; Smith 1989b; Reiner 1996; Smith 1999; Smith 2002).

***Gnathophis* sp.**

(Fig. 2 G)

**Material examined.** One specimen, 277.0 mm TL: MNHN 1989-351 (1, 277.0 mm), MD, 62 CB 103.

**Remarks.** *Gnathophis* sp. is known only from a single specimen identified earlier by Séret and Andreatta (1992) as *Gnathophis* sp. aff. *mystax* (Delaroche 1809). The number and pattern of lateral line pores are similar to *Gnathophis bathytopos*, with the second and the seventh to 13th pores elevated and a total of 39 pores to anal-fin origin, but it differs from *G. bathytopos* by having a pale stomach, and may represent an undescribed species (Smith pers. comm. 2005).

***Pseudoplichthys splendens* (Lea, 1913)**

(Fig. 2 H)

**Material examined.** One specimen, 277.0 mm TL: MNRJ 26828 (1, 277.0 mm), T, E-498.

**Distribution.** *Pseudoplichthys splendens* was described from the eastern North Atlantic, and is widespread in the tropical Atlantic. In the eastern Atlantic, it is known from the Azores to the Gulf of Guinea (Smith 1990); in the western Atlantic it is known from the east coast of Florida, USA, throughout the Gulf of Mexico, Caribbean, and Guyana to about 30° S off the Atlantic coast of South America (Uyeno *et al.* 1983; Smith 1989b; Smith 2002).

***Xenomystax congroides* Smith and Kanazawa 1989**

(Fig. 2 I)

**Material examined.** Three specimens, 316.0–768.0 mm TL: MNRJ 26815 (1, 768.0 mm), T, E-502; MNRJ 26816 (1, 491.0 mm), T, E-518; MNRJ 26851 (1, 316.0 mm), T, E-511.

**Distribution.** *Xenomystax congroides* is being reported by the first time in the WSA. It was described from off Suriname, and was also known from the Atlantic coast of Florida, USA, throughout the Gulf of Mexico and Caribbean to the mouth of the Amazon, in the northern coast of Brazil (Smith 1989b).

**Nemichthyidae**

***Avocettina acuticeps* (Regan 1916)**

(Fig. 2 J)

**Material examined.** Four specimens, 235.0–748.0 mm TL: MNRJ 27107 (1, 748.0 mm), T, E-522; MNRJ 27111 (1, 536.0 mm); MNRJ 27112 (1, 235.0 mm), AG, ASTRO2003020801; MNRJ 27113, (1, 249.0 mm), T, E-524.

**Distribution.** *Avocettina acuticeps* was described from a leptocephalus collected off southern Brazil, 21°00' S, 37°50' W (Nielsen & Smith 1978).

***Nemichthys curvirostris* Strömman 1896**

**Material examined.** Two specimens, 714.0–556.0 mm TL: MNRJ 32554 (2, 556.0–714.0 mm), T, E-523.

**Distribution.** *Nemichthys curvirostris* is being reported by the first time in the WSA. It was described from the western North Atlantic, from off Puerto Rico and has a circumglobal distribution between 40° N and 50° S, but is rarely found in the western Pacific (Nielsen and Smith 1978).



**Remarks.** *Nemichthys curvirostris* is being reported from a single lot with two specimens. Nielsen and Smith (1978) noticed that the distribution of *N. curvirostris* in the South Atlantic matches the collection stations made by the German R/V *Walther Herwig* in mid-Atlantic and that no other specimens were collected from off the coast of South America neither by that vessel nor other researchers. Menezes *et al.* (2003) reported *N. scolopaceus* from Northern Brazil, but referred to three lots (MCZ 61453, 86702, 147394) collected in the mid-Atlantic, outside Brazilian waters.

***Nemichthys scolopaceus* Richardson 1848**

(Fig. 3 A)

**Material examined.** Three specimens, 536.0–730.0 mm TL: MNRJ 26839 (1, 623.0 mm), T, E-523; MNRJ 26835 (1, 551.0 mm), T, E-551; MNRJ 27111 (1, 536.0 mm), T, D-502.

**Distribution.** *Nemichthys scolopaceus* was described from off Brazil based on material collected by H.M.S. *Samarang* (1843–1846), and is known to have a worldwide distribution in all tropical and temperate seas (Nielsen & Smith 1978, Smith & Nielsen 1989).

**Nettastomatidae**

***Hoplunnis similis* Smith 1989**

(Fig. 3 B)

**Material examined.** One specimen, 305.0 mm TL: USU 01327 (1, 305.0 mm), MD, 05 CP11.

**Distribution.** *Hoplunnis similis* was known from its type locality, in the Bahamas (20°53'N, 73°26'W), and from Florida, USA, Honduras and Nicaragua and southern Brazil (Castro & Bonecker 2004; Smith 1989c).

**Remarks.** USU 01327 was reported by Séret and Andreatta (1992) as *Facciolella oxyrhyncha*; another lot of *F. oxyrhyncha* was listed by those authors (USU 01391), but was not found in the USU collection.

***Nettastoma melanura* Rafinesque 1810**

(Fig. 3 C)

**Material examined.** 17 specimens, 412.0–724.0 mm TL: MNRJ 26817 (4, 505.0–724.0 mm), T, E-503; MNRJ 26818 (1, 522.0 mm), T, E-541; MNRJ 26819 (1, 507.0 mm), T, E-518; MNRJ 26820 (1, 637.0 mm), T, E-499; MNRJ 26821 (5, 523.0–650.0 mm), T, E-517; MNRJ 26822 (1, 481.0 mm), T, E-543; MNRJ 26823 (4, 412.0–653.0 mm), T, E-502.

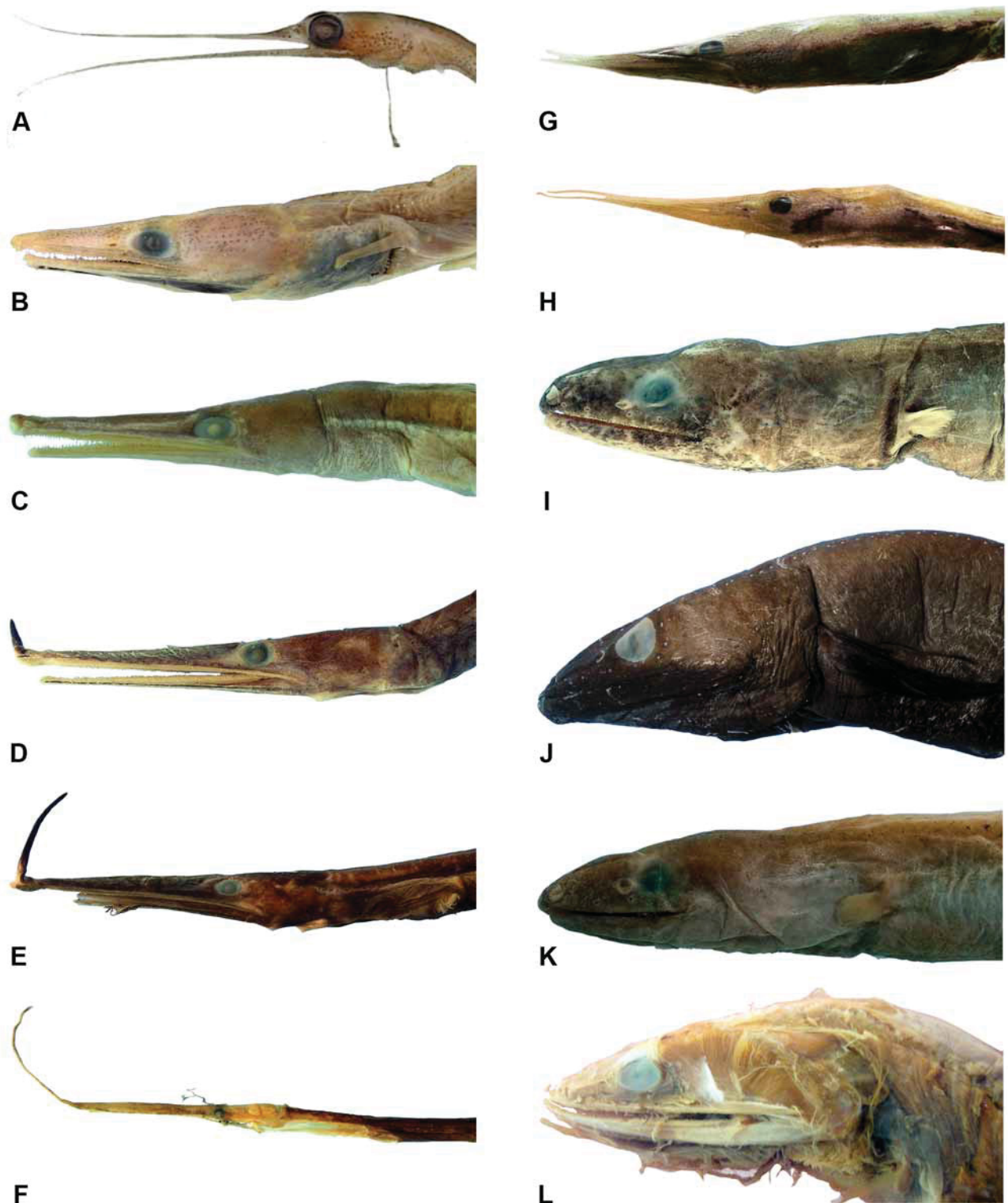
**Distribution.** *Nettastoma melanura* was described from Sicily, and is also known from the Mediterranean Sea and the tropical Atlantic. In the eastern Atlantic, it is recorded from Portugal to the Gulf of Guinea; in the western Atlantic, from the east coast of Florida, USA, throughout the Gulf of Mexico and the Caribbean, to southern Brazil (Figueiredo *et al.* 2002; Smith 1989c).

***Venefica* cf. *procera* (Goode & Bean 1883)**

(Fig. 3 D)

**Material examined.** 44 specimens, 102.0–1287.0 mm TL: MNRJ 26799 (1, 640.0 mm), T, E-505; MNRJ 26800 (3, 730.0–785.0 mm), T, E-497; MNRJ 26801 (5, 795.0–1157.0 mm), T, E-501; MNRJ 26802 (1, 999.0 mm), T, E-519; MNRJ 26803 (3, 746.0–996.0 mm), T, E-520; MNRJ 26804 (2, 830.0–897.0 mm), T, E-525;

MNRJ 26805 (1, 1170.0 mm), T, E-550; MNRJ 26806 (23, 683.0–1287.0 mm), T, E-496, MNRJ 26807 (2, 796.0 mm), T, E-510; MNRJ 26810 (1, 102.0 mm), T, E-549; UF 165826 (1, 977.0 mm), collected with MNRJ 26806; USNM 389076 (1, 887.0 mm), collected with MNRJ 26806.



**FIGURE 3.** (A) *Nemichthys scolopaceus* (MNRJ 26839, 623.0 mm); (B) *Hoplunnis similis* (USU 01327, 305.0 mm); (C) *Nettastoma melanura* (MNRJ 26820, 637.0 mm); (D) *Venefica* cf. *procera* (MNRJ 26799, 640.0 mm); (E) *Venefica* sp. 1 (MNRJ 26808, 992.0 mm); (F) *Venefica* sp. 2 (MNRJ 26809, 494.0 mm); (G) *Serrivomer schmidtii* (MNRJ 26842, 423.0 mm); (H) *Stemonidium hypomelas* (MNRJ 26838, 267.0 mm); (I) *Atractodenchelys phrix* (MNRJ 26829, 300.0 mm); (J) *Diastobranchus capensis* (MNRJ 26783, 642.0 mm); (K) *Dysommia rugosa* (MNRJ 27126, 242.0 mm); (L) *Histiobranchus* cf. *australis* (USU 01303, 559.0 mm).

**Distribution.** *Venefica procera* is being reported by the first time in the WSA. It was described from the western North Atlantic (33°35' to 34°00' N, 76°00' to 76°10' W), and is also known from North Carolina, USA, to Suriname, including the Gulf of Mexico and the Caribbean Sea (Smith 1989c).

**Remarks.** The genus *Venefica* is distinguished from other genera of the family Nettastomatidae by the presence of a fleshy proboscis on the tip of the snout. As presently known, the genus includes five valid species, which can be distinguished by the length of the proboscis, the form and location of the posterior nostril, number of head pores, and a few morphometric characters (Castle 1986c); however, the species are poorly characterized and the group is in need of revision (Smith 1989c). Examination of available material revealed three species: *Venefica* cf. *procera*, *Venefica* sp. 1 and *Venefica* sp. 2. *Venefica* cf. *procera* is diagnosed by a small proboscis (8.2 in head length); enlarged snout (45.0 in head length) and head (96.1 in distance from tip of snout to pectoral-fin origin); and snout and posterior nostrils located before the upper half of eye (vs. almost above the eyes in *V. multiporosa*); sensorial system: infraorbital 18, supraorbital 1+7, preoperculomandibular 19, Supratemporal 3, lateral line to dorsal-fin origin 5, lateral line to anal fin origin 63. The specimens reported here have slightly fewer pores in the supraorbital canal than Smith (1989c) reported for specimens in the North Pacific (1+7 vs. 1+8–12).

### ***Venefica* sp. 1**

(Fig. 3 E)

**Material examined.** One specimen, 992.0 mm TL: MNRJ 26808, 1 (992.0 mm), T, E-526.

**Distribution.** *Venefica* sp. 1 is only known from a single specimen, from 20°06' S, 38°40' W.

**Remarks.** The specimen has some characters in common with *Venefica tentaculata*, such as the proboscis length, which is moderately enlarged (16.3 % in head length); however, the snout is relatively shorter (36.2% in head length, vs. 48–49.5% in *V. tentaculata*). The posterior nostril is located in front of mid-eye and separated from it by a distance shorter than the orbit distance. The specimen listed here also differs from *V. tentaculata* in some meristic characters of sensorial canal: infraorbital 15 (vs. 16 in *V. tentaculata*), supraorbital 1+7 (vs. 1+9 in *V. tentaculata*), preoperculomandibular more than 12 (tip of lower jaw damaged; vs. 18 in *V. tentaculata*), supratemporal 3 (also 3 in *V. tentaculata*), lateral line to dorsal-fin origin 13 (vs. 7 to 10 in *V. tentaculata*), lateral line to anal-fin origin 63 (vs. 62–66 in *V. tentaculata*).

### ***Venefica* sp. 2**

(Fig. 3 F)

**Material examined.** One specimen, 494.0 mm TL: MNRJ 26809 (1, 494.0 mm), T, E-525.

**Distribution.** *Venefica* sp. 2 is only known from a single specimen, from 20°08' S, 38°38' W.

**Remarks.** *Venefica* sp. 2 has a much more elongate proboscis than the other two species mentioned above (about 23.3 in head length), a very elongate snout (26.2 in HL), small head (52.2 in distance from tip of snout to pectoral-fin origin), and posterior nostril located in front of mid-eye and separated from it by a distance larger than the orbit. The head of the specimen available was damaged, making counts of laterosensory pores impossible.

## **Serrivomeridae**

### ***Serrivomer schmidtii* Bauchot-Boutin 1954**

(Fig. 3 G)

**Material examined.** 23 specimens, 267.0–673.0 mm TL: MNRJ 26836 (3, 267.0–644.0 mm), T, E-550;

MNRJ 26840 (1, 376.0 mm), T, E-526; MNRJ 26842 (1, 423.0 mm), T, E-535; MNRJ 26843 (1, 571.0 mm), T, E-544; MNRJ 26844 (1, 347.0 mm), T, E-520; MNRJ 26845 (1, 290.0 mm), T, E-522; MNRJ 26846 (1, 670.0 mm), T, E-547; MNRJ 26847 (3, 600.0–673.0 mm), T, E-552; MNRJ 26848 (2, 302.0–336.0 mm), T, E-527; MNRJ 26849 (1, 631.0 mm), T, E-496; MNRJ 26850 (5, 275.0–586.0 mm), T, E-519; MNRJ 26858 (1, 289.0 mm), T, E-549; MNRJ 27106 (1, 653.0 mm), AG, ASTRO2003082703; USU 01404 (1, 389.0 mm), MD, 03 CP04.

**Distribution.** *Serrivomer schmidt* was described from the eastern South Atlantic (19°16' S, 01°48' W), and is widespread throughout the South Atlantic (Tighe 1989).

**Remarks.** Identification of the present material follows Bauchot-Boutin (1954), who separates *Serrivomer schmidt* from the very similar *S. beani* by the number of caudal-fin rays (seven for the former and five to six for the latter). USU 01404 was reported by Séret and Andreata (1992) as *Platuronides danae*.

### ***Stemonidium hypomelas* Gilbert 1905**

(Fig. 3 H)

**Material examined.** Eight specimens, 130.0–267.0 mm TL: MNRJ 26837 (2, 190.0–193.0 mm), T, E-519; MNRJ 26838 (1, 267.0 mm), T, E-527; MNRJ 26854 (1, 130.0 mm), T, E-538; MNRJ 26855 (1, 159.0 mm), T, E-506; MNRJ 26856 (1, 181.0 mm), T, E-505; MNRJ 26857 (1, 163.0 mm), T, E-536; MNRJ 26860 (1, 132.0 mm), T, E-550.

**Distribution.** *Stemonidium hypomelas* was described from Hawaii, and is known from the Pacific, Indian and Atlantic Oceans. In the Atlantic, it is known from 7° N to 23° S (Tighe 1989).

## **Synphobranchidae**

### ***Atractodenchelys phrix* Robins an Robins 1970**

(Fig. 3 I)

**Material examined.** One specimen, 300.0 mm TL: MNRJ 26829 (1, 300.0 mm), T, E-534.

**Distribution.** *Atractodenchelys phrix* is being reported by the first time in the WSA. It was described from the eastern Caribbean (11°36' N, 62°52' W) and is also known from the western Caribbean Sea, the Atlantic Ocean north of Puerto Rico to the coast of Florida (Robins & Robins 1989).

### ***Diastobranthus capensis* Barnard 1823**

(Fig. 3 J)

**Material examined.** 13 specimens, 642.0–1188.0 mm TL: MNRJ 26767 (3, 680.0–754.0 mm, 1 cs), T, E-540; MNRJ 26773 (1, 1141.0 mm), T, E-526; MNRJ 26775 (1, 1048.0 mm), T, E-526; MNRJ 26783 (3, 642.0–799.0 mm), T, E-496; MNRJ 26784 (1, 852.0 mm), T, E-537; MNRJ 26785 (1, 1049.0 mm), T, E-525; MNRJ 26786 (1, 724.0 mm), T, E-527; MNRJ 26787 (1, 1045.0 mm), T, E-527; MNRJ 26788 (1, 1188.0 mm), T, E-527.

**Distribution.** *Diastobranthus capensis* was described from South Africa. It is known from temperate waters of the eastern South Pacific, Indian Ocean, and WSA (Castle 1986b; Parin *et al.* 1995; Sulak & Shcherbachev 1997; Brickley & Laptikhovsy 2002). Recently, several specimens were collected in the western North Atlantic off New England, USA (about 40° N), thus extending the known distribution of the species to the northern hemisphere (Moore *et al.* 2003).



***Dysommia rugosa* Ginsburg 1951**

(Fig. 3 K)

**Material examined.** One specimen, 242.0 mm TL: MNRJ 27126 (1, 242.0 mm), T, D-502.

**Distribution.** *Dysommia rugosa* was described from off the eastern coast of the United States (30°53'00" N, 79°42'30" W), and is known elsewhere from the Caribbean and Brazil in the Atlantic, Hawaii in the Pacific, and Mozambique in the Western Indian (Haimovici *et al.* 1994; Robins & Robins 1989).

***Histiobranchus cf. australis* (Regan 1913)**

(Fig. 3 L)

**Material examined.** Three specimens, 448.0–559.0 mm TL: USU 01303 (1, 559.0 mm, x-rayed), MD, 38 CP 65; UF 231763 (2, 448.0–542.0 mm, x-rayed), R/V Gllis, off St. Paul Rocks, 05° 03' N, 20° 48' W, 2784 m.

**Distribution.** *Histiobranchus australis* is being recorded by the first time in the WSA. It was described from the western Indian and eastern South Atlantic Oceans (46°46' S, 45°31' E, 48°06' S, 10°05' W), and is also known from the East Indian and western South Pacific Oceans.

**Remarks.** USU 01303 was reported by Séret and Andreata (1992) as *Haptenchelys texis*. The specimen is poorly preserved, lacking skin, dorsal- and anal-fin rays, and infraorbital bones, and the musculature is disintegrating. The bones have also suffered from decalcification, making counts of vertebrae on an x-ray very difficult. The number of vertebrae seems to fit with *H. australis*: total vertebra ca. 135, precaudal vertebra equal to 60 (Karmovskaya & Merrett 1998). Additional material collected in Northern Brazil confirms the existence of *H. australis* in adjacent waters.

***Ilyophis blachei* Saldanha & Merrett 1982**

(Fig. 4 A)

**Material examined.** Two specimens 595.0–641.0 mm TL: MNRJ 26827 (2, 595.0–641.0 mm), T, E-528.

**Distribution.** *Ilyophis blachei* was described from the western North Atlantic (51°04' N, 11°59' W), and is known from the Rio Grande Rise in the WSA, temperate Indian Ocean, the eastern Atlantic from southern Africa and Europe, but is absent from the Equatorial region. (Parin *et al.* 1995; Sulak & Shcherbachev 1997).

***Ilyophis brunneus* Gilbert 1892**

(Fig. 4 B)

**Material examined.** One specimen, 279.0 mm TL: MNRJ 26826 (1, 279.0 mm), T, E-496.

**Distribution.** *Ilyophis brunneus* was described from the Galapagos Islands (0°36' S, 89°19' W) and is known elsewhere from all tropical and temperate seas, from about 51° N to 42° S (Sulak & Shcherbachev 1997).

***Simenchelys parasitica* Gill 1879**

(Fig. 4 C)

**Material examined.** Three specimens, 353.0–987.0 mm TL: MNRJ 26734 (1, 409.0 mm), T, E-525; MNRJ 26735 (1, 353.0 mm), AG, ASTRO2003021001; MNRJ 26736 (1, 987.0 mm), AG, ASTRO2003082601.

**Distribution.** *Simenchelys parasitica* was described from off Canada and has a worldwide distribution in temperate and tropical seas, from about 44° N to 42° S (Sulak & Shcherbachev 1997).

***Synaphobranchus affinis* Günther 1877**

(Fig. 4 D)

**Material examined.** 85 specimens, 108.3–559.0 mm TL: MNRJ 26757 (2, 406.0–532.0 mm), T, E-522; MNRJ 26758 (3, 389.0–443.0 mm, 1 cs), T, E-499; MNRJ 26759 (1, 559.0 mm), AG, ASTRO2003021301; MNRJ 26760 (30, 222.5–349.0 mm), D-502; MNRJ 26770 (25, 196.0–441.0 mm), T, D-503; MNRJ 26824 (1, 526.0 mm), T, D-506, 27125 (8, 263.0–371.0 mm), T, D-502; MNHN 1989-353 (1, 108.3 mm), MD, 58 CB 98; MNHN 1989-035 (6, 395.0 mm), MD, 65 CB 106; UF 165818 (2, 270.0–303.0 mm), collected with MNRJ 26760; UF 165815 (1, 354.0 mm), collected with MNRJ 26770; USU 01398 (1, 197.0 mm), MD, 65 CB 106; USU 01301 (1, 520.0 mm), MD, 06 CP 07; USNM 389073 (2, 255.0–297.0 mm), collected with MNRJ 26760; USNM 389074 (1, 354.0 mm), collected with MNRJ 26770.

**Distribution.** *Synaphobranchus affinis* is being recorded by the first time in the WSA. It was described from Japan and is also known from the tropical and temperate Atlantic, Indian and Pacific Oceans between 44° N and 42° S (Robins & Robins 1989; Sulak & Shcherbachev 1997).

**Remarks.** USU 01301 and USU 01398 were reported by Séret and Andreatta (1992) as *Synaphobranchus kaupii*, and NMHN 1989-353 as *Cynoponticus savanna*.

***Synaphobranchus brevidorsalis* Günther 1887**

(Fig. 4 E)

**Material examined.** 74 specimens, 102.0–1007.0 mm TL: MNRJ 26752 (1, 730.0 mm), AG, ASTRO2003021001; MNRJ 26753 (2, 398.0–880.0 mm), AG, ASTRO2003082703; MNRJ 26754 (1, 526.0 mm), T, E-551; MNRJ 26752 (1, 739.0 mm), AG, ASTRO2003021001; MNRJ 26755 (1, 955.0 mm), AG, ASTRO2003082601; MNRJ 26756 (1, 603.0 mm), AG, ASTRO2003082704; MNRJ 26768 (1, 803.0 mm), T, E-528; MNRJ 26769 (1, 102.0 mm), AG, ASTRO2003020803; MNRJ 26771 (13, 390.0–665.0 mm), T, E-526; MNRJ 26772 (8, 481.0–943.0 mm, 1 cs), T, E-537; MNRJ 26774 (7, 566.0–903.0 mm), T, E-549; MNRJ 26776 (13, 363.0–882.0 mm), T, E-496; MNRJ 26777 (1, 1007.0 mm), T, E-527; MNRJ 26778 (3, 578.0–870.0 mm), T, E-520; MNRJ 26779 (3, 455.0–657.0 mm), T, E-525; MNRJ 26780 (7, 345.0–718.0 mm), T, E-501; MNRJ 26781 (6, 533.0–970.0 mm), T, E-548; MNRJ 26782 (1, 839.0 mm), T, E-536; UF 165822 (1, 697.0 mm), collected with MNRJ 26776; USNM 389075 (2, 443.0–363.0 mm), collected with MNRJ 26776.

**Distribution.** *Synaphobranchus brevidorsalis* was described from off New Guinea and Japan, and is distributed in the tropical and temperate Pacific, Indian and Atlantic Oceans, from about 37°N to 29°S (Robins & Robins 1989; Sulak & Shcherbachev 1997).

***Synaphobranchus calvus* Melo 2007 (Fig. 4 F)**

**Material examined.** 203 specimens, 143.0–656.0 mm TL: as listed by Melo (2007).

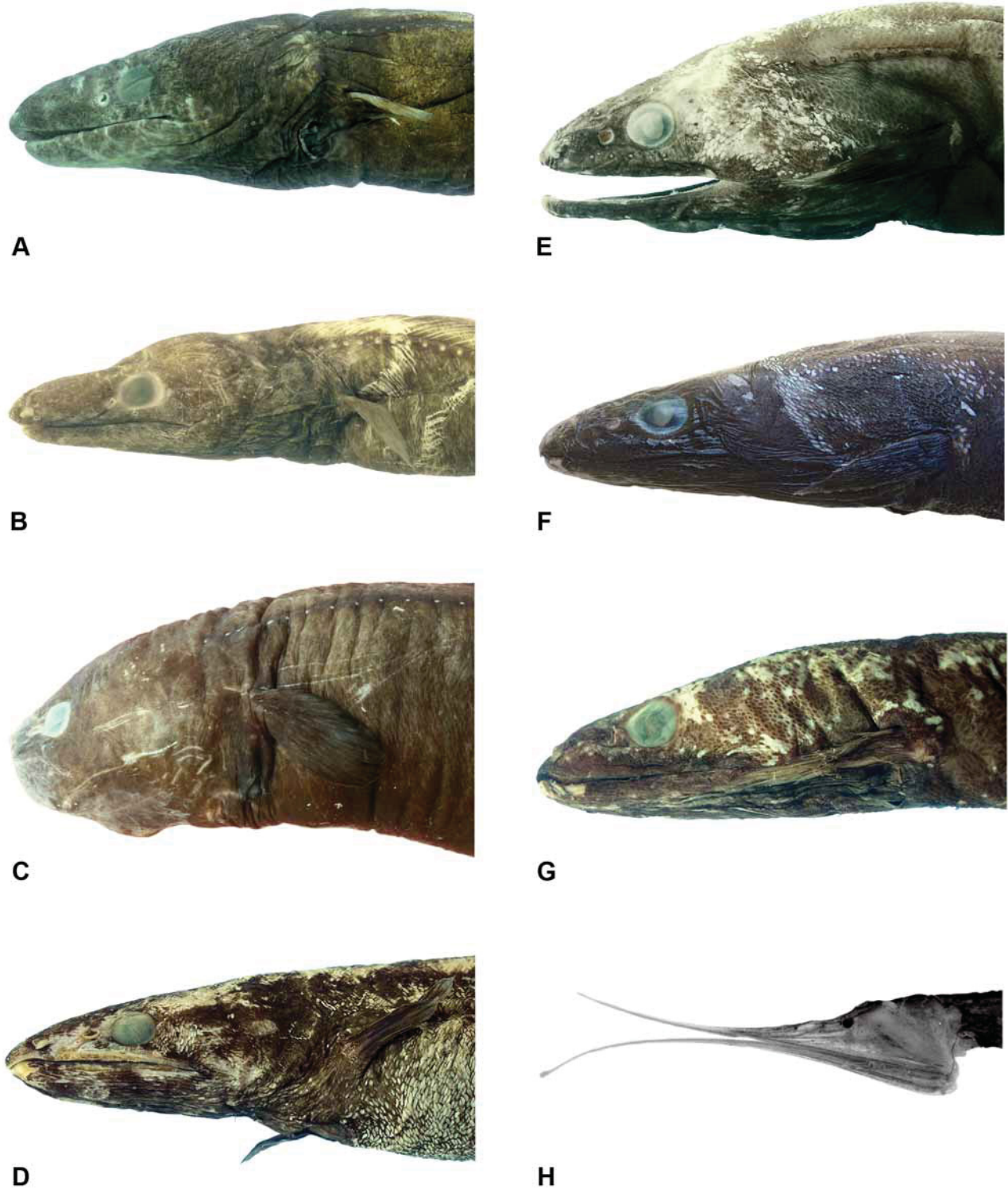
**Distribution.** *Synaphobranchus calvus* is known only from the area of study.

***Synaphobranchus oregoni* Castle 1960**

(Fig. 4 G)

**Material examined.** Nine specimens, 537.0–814.0 mm TL: MNRJ 26761 (1, 683.0 mm), AG, ASTRO2003021001; MNRJ 26762 (1, 650.0 mm), AG, ASTRO2003021002; MNRJ 26763 (1, 814.0 mm), T, E-549; MNRJ 26764 (1, 703.0 mm), AG, ASTRO2003020801; MNRJ 26765 (1, 605.0 mm), AG, 16B; MNRJ 26766 (1, 692.0 mm), T, E-528; MNRJ 26789 (1, 556.0 mm), AG, ASTRO2003021403; MNRJ 26791 (1, 605.0 mm), AG, ASTRO2003021002; MNRJ 27103 (1, 537.0 mm), T, E-507.

**Distribution.** *Synaphobranchus oregoni* was described from the Gulf of Mexico; it is also known from the Indian Ocean, tropical Atlantic, and eastern Pacific. In the WSA it was previously recorded from the Rio Grande rise (Robins & Robins 1989; Sulak & Shcherbachev 1997; Brickle & Laptikhovsky 2002).



**FIGURE 4.** (A) *Ilyophis blachei* (MNRJ 26827, 641.0 mm); (B) *Ilyophis brunneus* (MNRJ 26826, 279.0 mm); (C) *Simenchelys parasitica* (MNRJ 26736, 987.0 mm); (D) *Synaphobranchus affinis* (MNRJ 26758, 443.0 mm); (E) *Synaphobranchus brevidorsalis* (MNRJ 26782, 839.0 mm); (F) *Synaphobranchus calvus* (MNRJ 28279, 530.0 mm); (G) *Synaphobranchus oregoni* (MNRJ 27103, 537.0 mm); (H) *Cyema atrum* (MNRJ 26862, 101.0 mm).

## Saccopharyngiformes

### Eurypharyngidae

#### *Eurypharynx pelecانoides* Vaillant 1882

**Material examined.** 16 specimens, 345.0–519.0 mm TL: MNRJ 26863 (1, 385.0 mm), T, E-536; MNRJ 26864 (1, 422.0 mm), T, E-527; MNRJ 26865 (2, 352.0–381.0 mm), T, E-540; MNRJ 26866 (2, 280.0–428.0 mm), T, E-544; MNRJ 26867 (1, 551.0 mm), T, E-548; MNRJ 26868 (4, 345.0–519.0 mm), T, E-519; MNRJ 26869 (1, 465.0 mm), T, E-526; MNRJ 26870 (1, 493.0 mm), T, E-550; MNRJ 27099 (3, 190.0–403.0 mm), T, E-520.

**Distribution.** *Eurypharynx pelecانoides* was described from off Morocco (29°52' N, 11°44' W) and is known from all tropical and temperate seas. It was recorded before in the WSA from material obtained by the R/V *Walther Herwig* (Bertelsen *et al.* 1989).

### Cyematidae

#### *Cyema atrum* Günther 1878

(Fig. 4 H)

**Material examined.** Two specimens, 101.0–103.0 mm TL: MNRJ 26861 (1, 103.0 mm), T, E-540; MNRJ 26862 (1, 101.0 mm), T, E-529.

**Distribution.** *Cyema atrum* is being reported for the first time in the WSA. It was described from the south Pacific and Antarctic Oceans, and has a circumglobal distribution (Smith, 1989d).

## Discussion

### Biogeographic considerations

A considerable number of new records for deep-water eels are being recorded here: of the 33 species collected, 13 (39.4%) are being reported by the first time in the WSA. The species reported herein strengthen the notion of a strong zoogeographical affinity between the southern and northern parts of the western Atlantic. Of the 28 species identified to the species level, only *Synaphobranchus calvus* appears to be endemic. *Acromycter atlanticus*, *A. perturbator*, *Atractodenchelys phrix*, *Coloconger meadi* occur in the Gulf of Mexico and Caribbean, and *Hoplunnis similis*, *Ilyophis blachei*, *Venefica procera* and *Xenomystax congroides* are also known to occur off the Atlantic coast of United States.

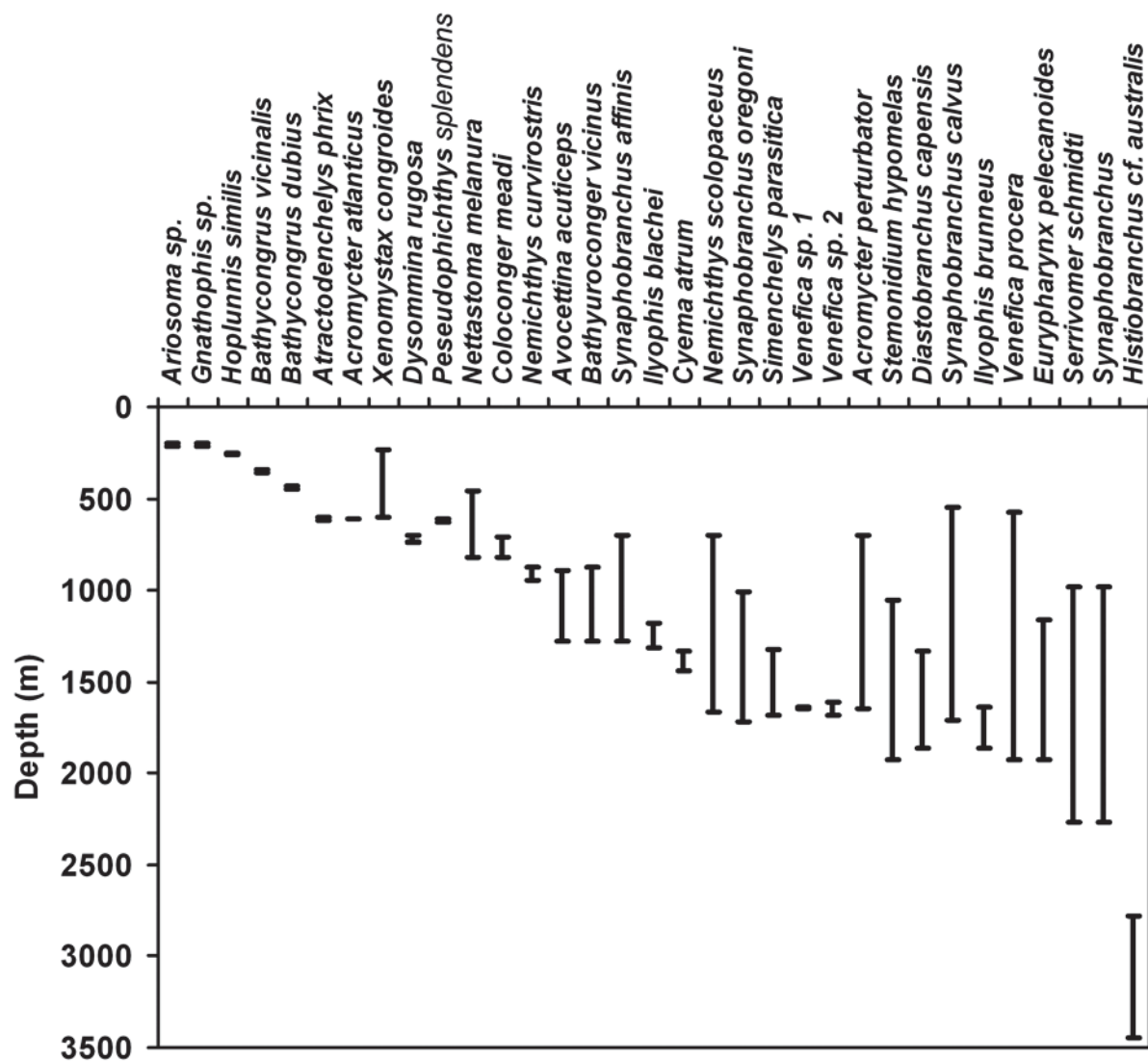
*Serrivomer schmidtii* is distributed in the South Atlantic, and *Bathyyuroconger vicinus*, *Nettastoma melanura* are widespread in the Atlantic. *Avocettina acuticeps*, *Cyema atrum*, *Dysommia rugosa*, *Diastobranchus capensis*, *Eurypharynx pelecانoides*, *Histiobranchus australis*, *Ilyophis blachei*, *I. brunneus*, *Nemichthys curvirostris*, *N. scolopaceus*, *Stemonidium hypomelas*, *Simenchelys parasitica*, *Synaphobranchus affinis*, *S. brevidorsalis*, and *S. oregoni* are also found elsewhere, outside of the Atlantic. The genus *Venefica* is in urgent need for revision, therefore, the distributions of *Venefica* sp. 1 and *Venefica* sp.2 cannot be given with precision. Also, additional material is needed to confirm the status of *Ariosoma* sp. and *Gnathophis* sp.

Considering only the species that are typically found below 200 m, another 18 species were recorded from WSA by previous authors (Menezes *et al.* 2003; Castro & Bonecker 2004; Bernardes *et al.* 2005): *Ariosoma opisthophthalmus* (Ranzani), *Avocettina acuticeps* (Regan), *A. paucipora* Nielsen and Smith, *Derichthys serpentinus* Gill, *Gnathophis mystax* (Delaroche), *Haptenchelys taxis* Robins and Martin, *Hoplunnis tenuis* Ginsburg, *Hoplunnis macrura* Ginsburg, *Labichthys carinatus* Gill and Ryder, *Meadia abyssalis* (Kamohara), *Nessorhamphus danae* Schmidt, *Ophichthus menezesi* McCosker and Böhlke, *Pseudomyrophis frio* (Jordan &



Davis), *Bathycongrus albescens* (Barnard), *Saccopharynx harrisoni* Beebe, *Saurenhelys cancrivora* Peters, *Serrivomer lanceolatus* (Schmidt), and *Venefica proboscidea* (Vaillant). Furthermore, some species previously reported from Brazil are not confirmed, because their records were based on misidentified specimens: *Facciolella oxyrhyncha* (= *Hoplunnis similis*); *Platuronides danae* (= *Serrivomer schmidtii*); *Cynoponticus savanna* (= *Synaphobranchus affinis*) and *Synaphobranchus kaupii* (= *Synaphobranchus affinis*).

The total number of deep-sea anguilliforms and saccopharyngiforms known to occur in the WSA has now risen to 48 species. Nevertheless, this number should still be regarded as an underestimate, considering that for the adjacent and intensively sampled western Central Atlantic, Smith (2002) listed 72 species just from depths below 200 m. Further expeditions to WSA will probably make available species not reported herein, especially from oceanic islands, northeastern Brazil, and the southern part of South America. Further efforts should also be made to sample at greater depths.



**FIGURE 5.** Bathymetric distribution of the anguilliforms and saccopharyngiforms eels from the Brazilian continental slope.

#### Bathymetric distribution of the species

The bathymetric distribution of the anguilliforms and saccopharyngiforms reported herein is summarized in figure 5. The species can be divided into two groups according to habitat: 1) benthic to benthopelagic, which leave on or near to the ocean floor and are more expected to be captured in demersal trawls, includes

Colocongridae, Congridae, Nettastomatidae and Synaphobranchidae; and 2) pelagic, which are typical from the water column and are only accidentally captured in demersal trawls, includes Europharyngidae, Cyematidae, Nemichthyidae, and Serrivomeridae. In this way, the depth records for the first group are more precise, since the families of the second group are accidentally captured during net transition. The high number of pelagic species collected can be explained by the large size of the net used by the French R/V *Thalassa*.

Haedrich and Merrett (1988) classified the deep-sea into seven arbitrary strata based on the vertical distribution pattern of North Atlantic demersal fishes: upper slope (200–750 m); middle slope (750–1500 m); lower slope (1500–2250 m); upper rise (2250–3000 m); middle rise (3000–3750 m); lower rise (3750–4500 m); and the abyss (> 4500 m). Along the Brazilian continental slope, the deep-sea eels and gulper eels have a gradual bathymetric transition of species, and such breaks are not very clear, even considering that some species may be accidentally captured.

The upper slope can be defined based on the exclusive presence of twelve species: *Acromycter atlanticus*, *Ariosoma* sp., *Atractodenchelys phrix*, *Gnathophis* sp., *Bathycongrus dubius*, *B. vicinalis*, *Colocongrer meadi*, *Dysommia rugosa*, *Hoplunnis similis*, *Nettastoma melanura*, *Pseudophichthys splendens*, and *Xenomystax congroides*. The genera *Ariosoma* and *Hoplunnis* are typically found in shallow waters, with the majority of species inhabiting the continental shelf; however, *Ariosoma selenops* and *Ariosoma balearicum* can be found in depths up to 700 m, and *Hoplunnis tenuis*, to about 460 m. (Lane & Stewart 1968; Smith 1989b).

Six species were found exclusively on the middle slope, *Avocettina acuticeps*, *Bathyrocongrer vicinus*, *Cyema atrum*, *Ilyophis blachei*, *Nemichthys curvirostris* and *Synaphobranchus affinis*, and three on the lower slope *Venefica* sp.1, *Venefica* sp. 2, and *Ilyophis brunneus*. *Avocettina acuticeps*, *C. atrum*, and *N. curvirostris* are pelagic and recorded from a few lots. Seven species have a wide range between middle and lower slopes: *Acromycter perturbator*, *Synaphobranchus calvus*, *Venefica procera*, *Synaphobranchus oregoni*, *Simenchelys parasitica*, *Diastobranchus capensis*, and *Synaphobranchus brevidorsalis*. Only *Histiobranchus australis* was collected on the middle rise, at 3442 m, a stratum that is not very well sampled. As expected, pelagic species were represented by few specimens, or appeared to have a broad range which can be a result of accidental catches: *Avocettina acuticeps*, *Eurypharynx pelecanoides*, *Nemichthys scolopaceus*, *Serrivomer schmidtii*, and *Stemonidium hypomelas*.

For most species, the depth distribution observed conforms precisely to their specific patterns shown elsewhere (Bertelsen *et al.* 1989; Haimovici *et al.* 1994; Karmovskaya & Merrett 1998). The zones are also very similar to those observed in the adjacent seas off Suriname and French Guiana (Mito & Inada 1983).

## Comparative material

*Venefica tentaculata* Garman: USNM 077490 (1, 513.0 mm); USNM 087564 (1, 694.0 mm); USNM 153604 (1, 525.0 mm); USNM 57895 (1, 737.0 mm). *Venefica multiporosa* Karrer: USMN 134971 (1, 303.0 mm). *Diastobranchus capensis* Barnard: MNRJ 27720 (former AUNH 31168-009, 2, 541.0–682.0 mm). *Meadia abyssalis* Kamohara: ASIZP0063196 (1, 54.0 mm); MZUSP 86457 (4, 428.0–521.0 mm); MZUSP 86458 (1, 526.0 mm); MZUSP uncat. (1, 257.0 mm). *Synaphobranchus kaupii* Johnson: MNRJ 27282 (former UF 115184, 2, 291.0–332.0 mm, 1 cs); MNRJ 27283 (former UF 1151187, 2 375.0–488.0 mm); USMN 365369 (1, 548.0 mm); USMN 186166 (1, 305.0 mm). *Synaphobranchus brevidorsalis* Günther: MNRJ 27281 (former UF 115000, 2, 525.0–439.0 mm), MNRJ 27280 (former UF 114951, (2, 402.0–329.0 mm, 1 cs); MNRJ uncat. (former USNM 34410, 1, 408.0 mm). *Synaphobranchus oregoni* Castle: MNRJ 27288 (former UF 233443, 2, 279.0–482.0 mm); MNRJ 27285 (former UF 212396, 2, 233.0–238.0 mm), MNRJ uncat. (former USMN 157955, 1, 326.0 mm).

## Acknowledgments

Loans and exchange of specimens were made available by S. Jewett, S. Riddle and J. T. Williams (USNM); J. Paxton, M. McGrouther (AM); P.A. Buckup (MNRJ); R.H. Robins and L. Page (UF); G. Duhamel, M. Pruvost (MNHN); D. Siebel, O. Crimmen, P. Campbell (BMNH); and J.V. Andreatta (USU). We are in debt to J. Figueiredo (MZUSP) for making specimens of *Meadia abyssalis* available; M. Hautecoeur (MNHN) for digital images of *Haptenchelys texis* (MNHN 1989-354); E. Tonomura, J. M. Guaranho (Departamento de Radiologia of Hospital Universitário Universidade Federal do Rio de Janeiro), and S. Raredon (USNM) for x-rays of specimens; N. Lujan, J. Armbruster, and B. Sidlauskas for comments and suggestions on the manuscript. CENPES/PETROBRAS made available for this study the specimens collected by R/V *Astro Garoupa*, as part of the project “Campos Basin Deep-sea Environmental Project”, coordinated by CENPES/PETROBRAS. This research received financial support from the Brazilian project REVIZEE (Evaluation of the Living Resources of the Exclusive Economic Zone). MRSM had a DTI fellowship from the Brazilian agency CNPq (process 38.2111/2001.0), and has a doctoral fellowship from the Brazilian agency CAPES (process 2030-03-9).

## Literature cited

- Bauchot-Boutin, M-L. (1954) Identification de *Serrivomer beani* Gill et Ryder (Téléostéen. Anguilliformes). *Bulletin du Museum National d'Histoire Naturelle*, 26(3), 301–306.
- Bernardes, R.A., Figueiredo, J.L., Rodrigues, A.R., Fischer, L.G., Vooren, C.M., Haimovici, M. & Rossi-Wongtschowski, C.L.B. (2005) *Peixes da Zona Econômica Exclusiva da Região Sudeste-Sul do Brasil: Levantamento com armadilhas, pargueiras e rede de arrasto de fundo*. Edusp, São Paulo, 304 pp.
- Berstelsen, E., Nielsen, J.G. & Smith, D.G. (1989) Suborder Saccopharyngoidei, families Saccopharyngidae, Eurypharyngidae and Monognathidae. In: Böhlke, E.B. (Ed.), *Fishes of the Western North Atlantic, Pt 9, 1*. Memoir Sears Foundation for Marine Research 1 (9), New Haven, pp. 636–655.
- Böhlke, E.B. (1989) Methods and Terminology. In: Böhlke, E.B. (Ed.), *Fishes of the Western North Atlantic, Pt 9, 1*. Memoir Sears Foundation for Marine Research 1 (9), New Haven, pp. 1–7.
- Braga, A.C., Costa, P.A.S., Lima, A.T., Nunan, G.W., Olavo, G. & Martins, A.S. (2007) Padrões de distribuição de teleósteos epi- e mesopelágicos na costa central (11–22° S) brasileira. In: Costa, P.A.S., Olavo, G. & Martins, A.S. (Eds.), *Biodiversidade da fauna marinha profunda na costa central brasileira*. Museu Nacional (Série Livros n.24), Rio de Janeiro, pp. 63–86.
- Brickle, P. & Laptikovsky, V. (2002) New records of deep-sea fishes from the waters around the Falkland Islands. *Journal of Fish Biology*, 60, 492–494.
- Castle, P.H.J. (1970) Ergebnisse der Forschungsreisen des FFS “Walther Herwig” nach Südamerika. XI. The Leptocephali. *Archiv für Fischereiwissenschaft*, 21, 1–21.
- Castle, P.H.J. (1986a) Family No. 40: Congridae. In: Smith, M.M. & Heemstra, P.C. (Eds.), *Smiths’ Sea Fishes*. Springer-Verlag, New York, pp. 161–165.
- Castle, P.H.J. (1986b) Family No. 46: Synphobranchidae. In: Smith, M.M. & Heemstra, P.C. (Eds.), *Smiths’ Sea Fishes*. Springer-Verlag, New York, pp. 188–190.
- Castle, P.H.J. (1986c) Family No. 47: Nettastomatidae. In: Smith, M.M. & Heemstra, P.C. (Eds.), *Smiths’ Sea Fishes*. Springer-Verlag, New York, pp. 190–191.
- Castro, M.S. & Bonecker, A.C.T. (2004) Leptocephali collected off the eastern coast of Brazil (12°–23° S). *Zootaxa*, 935, 1–28.
- Costa, P.A.S., Braga, A.C., Melo, M.R.S., Nunan, G.W.A., Martins, A.S. & Olavo, G. 2007. Assembléias de teleósteos demersais no talude da costa central brasileira. In: Costa, P. A.S., Olavo, G. & Martins, A.S. (Eds.), *Biodiversidade da fauna marinha profunda na costa central brasileira*. Museu Nacional (Série Livros n.24). Rio de Janeiro, pp. 86–107.
- Eschmeyer, W.N. (1998). *Catalog of fishes*. Special Publication, California Academy of Sciences, San Francisco. 3 vols. 2905 pp.
- Figueiredo, J.L., Santos, A.P., Yamaguti, N., Bernardes, R.A. & Rossi-Wongtschowski, C.L.B. (2002) *Peixes da Zona Econômica Exclusiva da Região Sudeste – Sul do Brasil: Levantamento com Rede de Meia-Água*. Edusp, São Paulo, 242 pp.
- Haedrich, R.L. & Merrett, N.R. (1988) Summary atlas of deep-living demersal fishes in the North Atlantic Basin. *Journal of Natural History*, 22, 1325–1362.

- Haimovici, M., Martins, A.S., Figueredo, J.L. & Vieira, D.C. (1994). Demersal bony fish of the outer shelf and upper slope of the southern Brazil Subtropical Convergence Ecosystem. *Marine Ecology Progress Series*, 108, 59–77.
- Karmovskaya, E.S. & Merrett, N.R. (1998) Taxonomy of the deep-sea eel genus, *Histiobranchus* (Synphobranchidae, Anguilliformes), with notes on the ecology of *H. bathybius* in the eastern North Atlantic. *Journal of Fish Biology*, 53, 1015–1037.
- Lane, E.D. & Stewart, K.W. (1968) A revision of the genus *Hoplunnis* Kaup (Apodes, Muraenesocidae), with a description of a new species. *Contributions in Marine Sciences*, 13, 51–64.
- Leviton, A.E., Gibbs Jr., R.H., Heal, E. & Dawson, C.E. (1985) Standards in herpetology and ichthyology. Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia*, 1985, 802–832.
- Melendéz, R. & Kong, I. (2000) Phylogenetic systematic in Chilean deep-sea fishes. *Estudios Oceanológicos*, 19, 129–136.
- Melo, M.R.S. (2007) A new synphobranchid eel (Anguilliformes: Synphobranchidae) from Brazil, with comments on the species from the western South Atlantic. *Copeia*, 2007, 315–323.
- Menezes, N.A., Buckup, P.A., de Figueiredo, J.L. & Moura, R.L. (2003) *Catálogo das espécies de peixes marinhos do Brasil*. Edusp, São Paulo, 160 pp.
- Mincarone, M., J.G. Nielsen & Costa, P.A.S. (2008). Deep-sea ophidiiform fishes collected on the Brazilian continental slope, between 11° and 23°S. *Zootaxa*, 1770, 41–64.
- Mito, K. & Inada, T. (1983) Outline of the survey result. In: Uyeno, T., Matsuura, K. & Fujii, E. (Eds.), *Fishes Trawled off Suriname and French Guiana*. Japan Marine Fishery Resource Research Center, Tokyo, pp. 20–21.
- Moore, J.A., Hartel, K.E., Craddock, J.E. & Galbraith, J.K. (2003) An annotated list of deepwater fishes from off the New England region, with the new area records. *Northeastern Naturalist*, 10, 159–248.
- Nakamura, I., Inada, T., Takeda, M. & Hatanaka, H. (1986) *Important Fishes Trawled off Patagonia*. Japan Marine Fishery Resource Research Center, Tokyo, pp. 68.
- Nielsen, J.G. & Smith, D.G. (1978) The eel family Nemichthyidae (Pisces, Anguilliformes). *Dana-Report*, 88, 1–71.
- Parin, N.V., Shcherbachev, Y.N. & Pakhorukov, M.P. (1995) Bottom and near-bottom fishes of the Rio Grande Rise (Southwest Atlantic Ocean). *Journal of Ichthyology*, 35, 205–219.
- Reiner, F. (1996) *Catálogo dos peixes do Arquipélago de Cabo Verde*. Publicações avulsas do IPIMAR, Lisboa, 339 pp.
- Robins, C.H. & Robins, C.R. (1989) Family Synphobranchidae. In: Böhlke, E.B. (Ed.), *Fishes of the Western North Atlantic, Pt 9, 1*. Memoir Sears Foundation for Marine Research 1 (9), New Haven, pp. 207–253.
- Séret, B. & Andreata, J.V. (1992) Deep-sea fishes collected during the oceanographic cruise MD-55 off Brazil (6 May – 2 June 1987). *Cybium*, 16, 81–100.
- Smith, D.G. (1989a) Family Colocongridae. In: Böhlke, E.B. (Ed.), *Fishes of the Western North Atlantic, Pt 9, 1*. Memoir Sears Foundation for Marine Research 1 (9), New Haven, pp. 413–419.
- Smith, D.G. (1989b) Family Congridae. In: Böhlke, E.B. (Ed.), *Fishes of the Western North Atlantic, Pt 9, 1*. Memoir Sears Foundation for Marine Research 1 (9), New Haven, pp. 460–567.
- Smith, D.G. (1989c) Family Nettastomatidae. In: Böhlke, E.B. (Ed.), *Fishes of the Western North Atlantic, Pt 9, 1*. Memoir Sears Foundation for Marine Research 1 (9), New Haven, pp. 568–612.
- Smith, D.G. (1989d) Family Cyematidae. In: Böhlke, E.B. (Ed.), *Fishes of the Western North Atlantic, Pt 9, 1*. Memoir Sears Foundation for Marine Research 1 (9), New Haven, pp. 630–635.
- Smith, D.G. (1990) Congridae. In: Quéro, J.C., Hureau, J.C., Karrer, C., Post A. & Saldanha L. (Eds.), *Check-list of the Fishes of the Eastern Tropical Atlantic (CLOFETA), Vol. 1*. JNICT, Lisbon, SEI, Paris, and UNESCO, Paris, pp. 156–167.
- Smith, D.G. (1999) Congridae. In: Carpenter, K.E. & Niem, V.H. (Eds.), *FAO Species Identification Guide for Fishery Purposes. The Living Marine Resources of the Western Central Pacific. Volume 3. Batoid Fishes, Chimaeras and Bony Fishes part 1 (Elopidae to Linophrynidae)*. Food and Agriculture Organization of the United Nations, Rome, pp. 1397–2068.
- Smith, D.G. (2002) Congridae. In: Carpenter, K.E. (Ed.), *FAO Species Identification Guide for Fishery Purposes. The Living Marine Resources of the Western Central Atlantic. Volume 2. Bony fishes part 1 (Acipenseridae to Grammatidae)*. Food and Agriculture Organization of the United Nations, Rome, pp. 743–750.
- Smith, D.G. & Nielsen, J.G. (1989) Family Nemichthyidae. In: Böhlke, E.B. (Ed.), *Fishes of the Western North Atlantic, Pt 9, 1*. Memoir Sears Foundation for Marine Research 1 (9), New Haven, pp. 441–460.
- Sulak, K.J. & Shcherbachev, Y.N. (1997) Zoogeography and systematics of six deep-living genera of synphobranchid eels, with a key to taxa and description of two new species of *Ilyophis*. *Bulletin of Marine Science*, 60, 1158–1194.
- Tighe, K.A. (1989) Family Serrivomeridae. In: Böhlke, E.B. (Ed.), *Fishes of the Western North Atlantic, Pt 9, 1*. Memoir Sears Foundation for Marine Research 1 (9), New Haven, pp. 613–627.
- Uyeno, T., Matsuura, K. & Fujii, E. (1983) *Fishes Trawled off Suriname and French Guiana*. Japan Marine Fishery Resource Research Center, Tokyo, pp. 108.
- Wüst, G. (1964) The major Deep-Sea Expeditions and Research Vessels 1873–1969. *Progress in Oceanography*, 2, 3–52.